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SURVEY ON INDUSTRY REQUIREMENTS AND DRIVERS FOR THE DEVELOPMENT OF A PROCESS-RELATED CERTIFICATION SCHEME FOR ECODESIGN IMPLEMENTATION AND MANAGEMENT

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Abstract: Despite the existence of a large amount of eco-labels and eco-standards for product declaration, there is still limited research for the development of process-related certification schemes dealing with ecodesign implementation and management. In order to identify companies' drivers, barriers and expected benefits in regards to the development and application of process-related ecodesign certification schemes, a survey was carried out in this research. This paper presents and discusses the main results obtained in the survey, which comprised the participation of more than 100 professionals from more than 25 countries. The results will be employed for the development of an ecodesign process-related certification scheme based on the Ecodesign Maturity Model (EcoM2).

1. INTRODUCTION

Ecolabel is a "label which identifies overall, proven environmental preference of a product or service within a specific product/service category" [1].

By providing easily interpretable information [2], ecolabels support consumers to make informed decisions favoring products that can potentially reduce environmental impact, indirectly influencing industry in the definition of requirements for the development of new products [3]. Ecolabels provide instruments to measure and communicate the environmental performance of products, allowing comparisons and benchmarking among competitors [4].

ISO 14020:2000 [5] classifies ecolabels into three types: Type I (multi-criteria third-party programs); Type II (self-declared environmental claims); and Type III (quantified data on products based on independent verification). Type I labels have been the most successful, since labels of Type II do not have the same image of impartiality (they are self-attributed), whereas Type II labels are still rare [6].

There is a high variety of eco-labelling programs at European and international levels [4]. Each individual (competing) eco-label has its own scales, measurements and performance indicators, leading to confusion among customers and other stakeholders, and thus limiting the intended achievement of ecodesign benefits [4]. The number of new eco-label program keeps increasing significantly [2]. Currently, 457 ecolabels in 197 countries, and 25 industry sectors are tracked by the Ecolabel Index [7].

Ecolabels have a clear physical product perspective [2], being, for that reason, sector-specific in most of the cases (i.e. highly dependent on the product categories).

Despite the existence of a large amount of eco-labels for product declaration, there is still limited research for the development of process-related certification schemes dealing with ecodesign implementation and management. ISO 14006 [8], for example, provides guidelines for incorporating ecodesign into the environmental management systems, but is not a certifiable standard.

Certified management systems (or process-related certification schemes) provide a compilation and codification of available best practices and reduce the costs associated with searching for these practices and their associated benefits [2][9]. Eco-certification can be used as a signaling mechanism of environmental and/or quality attributes to stakeholders who value these attributes [2].

A process-related ecodesign certification scheme for ecodesign implementation would allow the evaluation of entire companies and/or business units according to their management practices integrated into the product development and related processes (such as procurement, marketing, manufacturing, etc.),

providing a broad overview of how environmental issues are considered in the entire product portfolio of a company.

In order to deploy requirements for the development of a process-related ecodesign certification scheme, this research identified the main drivers, barriers and expected benefits for product development companies in regards to the application of a process-related certification scheme for ecodesign implementation by means of a survey.

The next section details the methodology employed in this research. Section 3 presents and discusses the results obtained in the survey, highlighting the main outcomes. Final remarks and references are presented in sections 4 and 5, respectively.

2. METHODOLOGY

In order to identify companies' drivers, barriers and expected benefits in regards to the development and application of process-related ecodesign certification schemes, an exploratory survey was carried out in this research. Exploratory surveys aim to gain preliminary insight into a topic, providing the basis for more in-depth survey research [10].

The main steps carried out in this research for the development of the survey are:

1) Identification of existing process-related certification schemes

The identification of process-related certification schemes was performed based on a Systematic Literature Review in two databases: Science Direct and Scopus, resulting in the identification of 278 papers in total. By applying the exclusion criteria, 40 papers were selected for further analysis, resulting in the identification and systematization of eight process-related certification schemes (e.g.: ISO 14.001, ISO 9.001 and EMAS).

2) Analysis of drivers, barriers, stakeholders, applicability and requirements for existing process-related certification schemes

Each certification scheme was further analysed in regards to its overall drivers, barriers, stakeholders, applicability and requirements, enabling the comparison among them and providing valuable elements to be included into the survey questionnaire, developed in the next step.

3) Iterative development of the questionnaire and pilot testing

The target group for this survey comprised professionals with experience on ecodesign implementation in companies with in-house product development and/or consultancies who provide ecodesign services. Based on the identification of the target group, two set of questions were formulated to include both consultants and employees working in a product development company in the survey.

The conceptual model of the questionnaire was developed by breaking down the overall goal of the survey into several constructs and objectives, based on the results obtained in the previous step. In addition to the core questions, specific questions were designed for the characterization of the respondents. In order to ensure a good flow, a careful definition of the questions' ordering was also performed.

The pilot testing was carried out in four rounds: I) internal evaluation at the research group, II) evaluation by three industrial partners and one sustainability expert; III) evaluation by ecodesign expert with survey experience; and IV) evaluation by a survey expert and a native English speaker (to correct grammar and spelling). The evaluation criteria adopted in the pilot testing were defined according to Baker (2002) and comprised the evaluation of answering options, meaning, difficulty, order of questions, respondents' interest and attention, and timing.

4) Identification of relevant stakeholders to be involved in the survey

Several stakeholders were mapped for the dissemination of the survey, including industrial partners, consultants, research organizations and universities, LinkedIn groups, speakers from environmental conferences, contacts form previous surveys and environmental associations.

5) Design and release of the survey

The survey was made available in Survey Monkey, an online tool that allows to publish surveys and collect responses. During the survey release, the identified stakeholders were contacted through varied channels: personal e-mails, LinkedIn messages, indirect contact through network and contact by associations.

6) Analysis of the results

The results of the survey were analysed using descriptive and semi-quantitative approaches, and are presented in the next section.

3. RESULTS AND DISCUSSION

This session presents and discusses the results of the survey. Section 3.1 presents the characterization of the respondents, and is followed by the results in regards to: internal and external drivers (section 3.2), barriers (section 3.3), benefits (section 3.4), preferred type of certification (section 3.5) and interest in having a process-related certification tool (section 3.6).

3.1. Characterization of the respondents

In total, 105 professionals from product development (56.6%) and consultancy (43.4%) companies from more than 25 countries participated in the survey. The sample includes only professionals directly involved and/or with previous experience in ecodesign implementation and management.

The survey was divided into two tracks: one for product development companies and one for consultancy companies. While product development companies provided their own opinion about the questions, consultancy companies were asked to answer on behalf of their customers (i.e. product development companies that they provide support for ecodesign implementation).

Manufacture of machinery and equipment (14.7%), Manufacture of computer, electronic and optical products (13.2%) and Manufacture of electrical equipment (11.8%) are the most representative sectors for product development companies, from the more than 15 different identified sectors. The most significant sectors mentioned by the consultants are Manufacture of furniture, Manufacture of machinery and equipment and Manufacture of electrical equipment, each one accounting with 38.6%. Consultants stated to provide services for all the listed sectors (based on ISIC [11] classification).

The majority of respondents for product development companies (61.8%) work in larger companies, most of them in companies with more than 10,000 employees (38.3%). Small (under 50 employees) and medium sized (51 - 249 employees) companies are also represented with 20.6% and 17.6%, respectively. Most of the consultancy companies are small (70.18%), and provide services for companies with varied sizes.

Most of the product development companies have implemented ISO 9.001 – Quality Management Systems (80%) and ISO 14.001 – Environmental Management Systems (75.4%) standards. However, the consultants who provide or recommend these two certifications to its clients are more than 20% lower. Only 10.7% of the product development companies state that they do not have process certifications.

An analysis of the application of process certifications according to the size of product development companies shows an interesting picture: 50% of the small companies and 9% of the medium companies have stated that they do not have certification, while 0% of large companies had a similar statement.

When comparing the responses for process and product certifications for the product development companies, 10.7 % of the respondents state that they do not have process certification, whereas 43.5% states that do not they have environmental product certification[1]. The results indicate that product development companies have the tendency to have more process certifications than product certifications. On the other hand, 13.7% consultants have stated that they do not recommend or provide any product certification, where 27.5% have answered not to recommend process certifications.

In total, 80% of the respondents from small sized companies have stated that they do not have environmental product certification, indicating that small companies tends to obtain fewer certifications compared to medium and large companies.

3.2. Internal and external drivers

Drivers are defined in this research as motivations and/or incentives to implement a process-related certification scheme [12]. The three most important internal and external drivers for obtaining an ecodesign certification for the product development and related processes were identified by the respondents. The internal drivers are presented in Table 1 for product development (PD) companies and consultancies (CO).

Table 1: Internal drivers for the implementation of process-related ecodesign certification schemes

Internal drivers	**PD**	**CO**
Compliance with environmental strategy/policy	64.6%	55.4%
Cost reduction	30.8%	42.8%
Improved corporate responsibility	43.1%	23.2%
Improved environmental image	46.1%	48.2%
Need for a systematic process for ecodesign	32.31%	33.9%
Communication of ecodesign activities and processes	27.7%	32.1%
Other internal drivers	16.9%	12.5%

Both product development companies and consultants identified “compliance with environmental strategy/ policy” as the most important internal driver for a process-related ecodesign certification scheme. “Improved environmental image” seems important for both product development companies and consultancies as well. However, “cost reduction” is prioritized higher for consultants than for product development companies. The respondents of product development companies also identified “improved corporate responsibility” as an important driver.

The external drivers for the implementation of process-related certification schemes for ecodesign implementation are presented in Table 2. Each respondent could select the three most important external drivers.

[1] Examples of product certification includes Blue Angel, Cradle to Cradle Certification, Environmental Product Declaration (EPD), EPEAT®, EU Ecolabel, Energy Star, Fairtrade Certification, Nordic Ecolabel or “Swan”, etc.

Table 2: External drivers for the implementation of process-related ecodesign certification schemes

External drivers	PD	CO
Competitive advantage	68.2%	62.5%
Differentiation in the market	57.1%	42.9%
Fulfillment of customer requirements	50.8%	57.1%
Legislation compliance	34.9%	33.9%
New market opportunities	34.9%	50%
Pressure from stakeholders	7,9%	16.1%
Other external drivers	4.8%	5.3%

"Competitive advantage" is identified as the most important external driver for the respondents. The respondents from product development companies and consultancies agree on it by a response rate of 68.2% and 62.5%, respectively. They do also agree that "fulfilment of customers' requirements" is an important driver.

3.3. Barriers

Barriers can be defined as something that prevents the organisation from implementing a given approach [13]. This question aimed to identify which barriers might prevent the respondents from obtaining a process-related ecodesign certification for the product development and related processes. The significance of each barrier was evaluated by the respondents following a four-point Likert Scale: 1) High significance; 2) Medium significance; 3) Low significance; 4) Don't know/not applicable.

Figure 1 presents the results for product development (PD companies). The results indicates that the three barriers of highest significance for product development companies are "high cost", "high

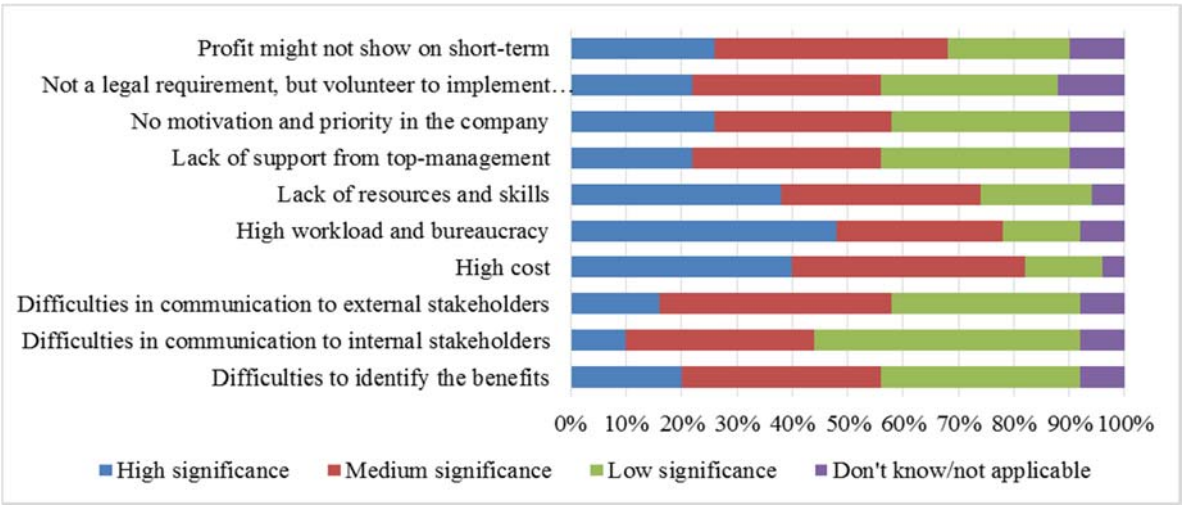

Figure 2: Significance of barriers for product development (PD) companies

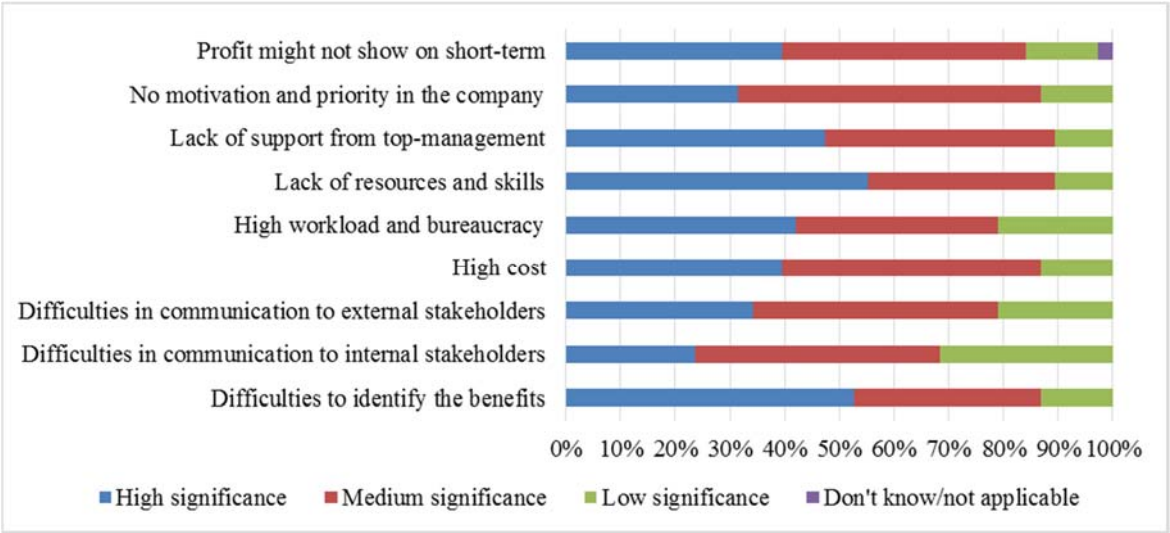

Figure 2: Significance of barriers for consultancy (CO) companies

workload and bureaucracy" and "lack of resources and skills". Other barriers mentioned by product development companies include:

- Many other competing demands;
- Large set of certificates and data to maintain;
- Lack of supply chain willingness to share information;
- Cost vs benefits;
- Lack of environmental education;
- Lack of harmonisation criteria;
- Lack of availability of a suitable certification for ecodesign.

Figure 2 presents the consultancies' evaluation of the significance of the barriers for manufacturing companies engaging in the implementation of process-related ecodesign certification schemes. The three barriers assigned with the highest significances are "difficulties to identify the benefits", "lack of resources and skills" and "lack of support from top-management". Other barriers mentioned by respondents from consultancies can be summarized as:

- Perceived added risk in terms of quality, durability and project delays;
- Knowledge about ecodesign certification;
- Organisations fail to see the strategic value;
- Lack competence to score ecodesign in a strategic way.

Overall, rrespondents from consultancies address higher significance for the barriers when compared to the respondents from product development companies. The barrier assigned with the lowest significance (for both PD companies and consultants) is "difficulties in communication to internal stakeholders".

3.4. Benefits

Benefits can be seen as advantages expected to be gained as a consequence of the implementation of a given approach [14]. Benefits related to branding, image and process management improvement were explored in the survey.

Table 3 presents the results related to the most important branding and image benefits for implementing a process-related ecodesign certification for product development and related processes. "Competitive advantage due to ecodesign branding" is the benefit that has the highest number of responses by both product development companies and consultancies (59%). It is in accordance with the result in the question about external drivers, where competitive advantage also had the highest response rate (see Table 2).

Table 3: Branding and image benefits for product development (PD) companies and consultancies (CO)

Branding and image benefits	**PD**	**CO**
Certification label for external communication	53.3%	53.1%
Competitive advantage due to ecodesign branding	56.6%	53.1%
Easier achievement of eco-labelling for new products	18.3%	16.3%
Improved company reputation/image	50.0%	57.1%
Improved internal environmental awareness	31.7%	20.4%
Development of products with a better env. performance	51.7%	36.7%
Other branding and image benefits	5.0%	6.1%

The same goes for "improved company reputation/ image" that is identified as both an important driver and benefit. The importance of the development of products with a better environmental performance addressed by PD companies must be highlighted.

The responses in Table 3 also indicate that having a certification label is an important part of the certification. Other branding and image benefits cited by the respondents included positive business impact and increased sales.

Process management and additional benefits that the respondents expect to gain from implementing an ecodesign certification for the product development and related processes were also identified in this research (Table 4).

Table 4: Process management and additional benefits for product development (PD) companies and consultancies (CO)

Process management and additional benefits	**PD**	**CO**
Continuous improvement of ecodesign implementation	62.7%	35.4%
Improved communication and knowledge sharing on ecodesign	42.4%	37.5%
Improved documentation of the ecodesign process	30.5%	10.4%
Increased knowledge on ecodesign management	39.0%	31.2%
Improved responsibility deployment for ecodesign implementation	32.2%	20.8%
Internal common language for ecodesign implementation	17.0%	10.4%

Improved internal environmental awareness in product development	44.1%	20.8%
Increased productivity and efficiency in product development	25.4%	33.3%
Reduction of costs	22.0%	33.3%
Support for ISO 14001 certification	15.2%	12.5%
Other benefit	5.1%	2.1%

While "continuous improvement of ecodesign implementation" and "improved internal environmental awareness in product development" were identified as the most important process management benefits for product development companies, with 62.76% and 44.1% respectively, only 35.4% and 20.8% of consultancies agree that this is an important benefit for their clients. On the other side, product development companies and consultancies seems to agree on the importance of "improved communication and knowledge sharing on ecodesign".

3.5. Preference on type of certification

This question aimed to identify what type of certification is preferred by the respondents. Three main types of certification were surveyed:

- Certification at different levels (e.g. bronze, silver and gold);
- Certification on a single level (certified or not);
- Certification based on a score (e.g. 0 to 100).

The results are presented in Table 5. The category with higher preference seems to be the single level certification (with 31.8% of the answers for product development companies and 31.5% for consultancies). Furthermore, a significant amount of answers from product development companies for a certification at different levels (23.8%) and based on a score (25.4%) can be observed.

Table 5: Preference on certification type for product development (PD) companies and consultancies (CO)

Type of certification	DP	CO
Certification at different levels (e.g. bronze, silver, gold)	23.8%	27.8%
Certification on a single level (certified or not)	31.8%	31.5%
Certification based on a score (e.g. 0 to 100)	25.4%	11.1%
Have no preference	19.0%	29.6%

In order to understand the preference of the respondents, the multiple-choice question was followed by an open-question, where the respondent could elaborate on the preference over a certain certification type. The comments by the respondents are summarised in Tables 6 (single level), 7 (different levels) and 8 (based on a score).

Table 6: Comments from respondents on why they prefer a single level certification

	PD company	Consultancy
Single level	• Simpler • Easier to communicate to customers • Easier to maintain • Difficult to have objective scores • Experience with LEED (based on levels) are quite cumbersome	• Simpler • Quicker for customers to understand (but they might find the score more useful after a while) • Reminds of ISO 14001 • Single certification have enough potential • Any certification is related to a high performance

50% of the comments in preference of a single level stated it was because it is a simpler or easier solution compared to different levels or based on a score. It relates to the statement that it is easier to work with a single score certification and to communicate the certification to the customers.

Table 7: Comments from respondents on why they prefer a certification at different levels

	PD company	Consultancy
Different levels	• Provide a more nuanced picture • Better maturity-based transparency • Levels act as motivators to improve ecodesign activities • Step-by-step implementation • Simple	• Useful tool for benchmarking • Clients prefers certifications in levels • Implementation in steps – learn to walk before run • Seems more trustworthy • Differentiation in market place

27% of the respondents, who prefers certification at different levels, perceive the different levels to be a simple solution as well (especially in comparison with the score solution). About 27% states that the different levels provide a more nuanced picture and about 20% states that it is easier to differentiate your company from others. It is also mentioned that the

implementation can be done step-by-step. Circa 40% states that the different levels will support continuously improvement of ecodesign practices.

Table 8: Comments from respondents on why they prefer a certification based on a score

	PD company	Consultancy
Based on a score	• Clear picture of companies' eco-performance • Benchmarking • Easier to set small goals • Show progress • Better for continuously improvements	• Better for internal use • Demands are constantly changing

The comments on the score are similar to those for the different levels. About 58% of the respondents, who commented on their preference for the score solution, stated that the possibility to differentiation or/and benchmarking supports the score solution. About 38% said that the score solution supports small goals or showing progress.

3.6. Interest in ecodesign certification

Part of the overall goal of the survey was to identify the interest for an ecodesign certification for the product development and related processes. This question asks the respondents about their interest, and is followed by an open question where the respondent can comment on their reasons upon their interest. The results are presented in Table 9.

Table 9: Interest in ecodesign certification for product development (PD) companies and consultancies (CO)

Interest in ecodesign process-related certification	PD	CO
Very interested	22.0%	10.4%
Interested	28.8%	35.4%
Only partly interested	35,6%	37.5%
Not interested	8.5%	6.2%
Don't know	5.1%	10.4%

Table 9 indicates that the majority of respondents for both product development companies (50.8%) and consultancies (45.8%) are interested or very interested in an ecodesign certification for the product development and related processes.
Table 10 highlights the comments provided by the respondents from product development (PD) companies that would be either "very interested" or "interested" in implementing a process-related ecodesign certification scheme.

Table 10: Comments from product development (PD) companies that are interested or very interested

	PD companies
Very interested	• Increases the chances of exporting our products • Sustainability as competitive edge • Spreading of environmental awareness • Have similar certifications • Facilitate acceptance of ecodesign processes in company
Interested	• Currently, not possible to reuse certification for other products • Prefer one certification instead of many • Better credibility and commitment to ecodesign activities • Systematic use of ecodesign • Interested, but a decision for top management • Improved image

Table 11 highlights the comments provided by consultants that believes that their customers would be either "very interested" or "interested" in implementing a process-related ecodesign certification scheme.

Table 11: Comments from consultancies that believes their clients will be interested or very interested

	Consultancies
Very interested	• Tool to organise ecodesign processes • Obtaining a certification • Industry wants to communicate their ecodesign efforts
Interested	• Complement to ISO 9001 and ISO 14001 • Clients wants to differentiate in market • Image as environmental friendly • Clients might overlook a new certification because they are busy • Link strategic sustainable development at the top management level • Trustworthy (but it is a new certification, so it has to become known first)

Table 12 presents the comments provided by the respondents from product development (PD)

companies that are only partly interested or not interested in a process-related ecodesign certification scheme.

Table 12: Comments from product development (PD) companies that are only partly interested or not interested

	PD companies
Only partly interested	• Customers are not asking for it • Satisfied with current certification(s) • Prefer product certification • Do not follow the implemented ISO 14001 • The certification is not specified enough • Require proof of cost reduction • Limited time • Lack of resources • No internal support
Not interested	• No extra benefits added • Too much bureaucracy • No time to devote • Improved image

Table 13 highlights the comments provided by consultants that believes that their customers would be either "only partially interested" or "not interested" in implementing a process-related ecodesign certification scheme.

Table 13: Comments from consultancies that believes their clients will be only partly interested or not interested

	Consultancies
Only partly interested	• Insufficient understanding of ecodesign process • Difficult to assess environmental impact • Only if it reduces cost • Small companies lack in resources
Not intereste	• No need for another certificate. A ecodesign process cannot be certified - only the result of the process by e.g. an LCA (Life Cycle Assessment)

Circa 16% of those who have stated "only partly interested" have commented that it is because the business model behind the ecodesign certification is not detailed yet. Especially a proven cost reduction seems important for these respondents before being interested.

4. FINAL REMARKS

This paper presented the results of a survey carried out to identify companies' drivers, barriers and expected benefits in regards to the development and application of process-related ecodesign certification schemes. The main results obtained in the survey indicates that:

- Process-certification schemes are more applied by manufacturing companies than the product-certification ones;
- Compliance with environmental strategy/ policy and improved environmental image are the most important internal drivers;
- Competitive advantage and fulfillment of customers requirements are the most important external drivers;
- High work load and bureaucracy and lack of resources and skills are the most important barriers;
- Competitive advantage due to ecodesign branding, improved company reputation/ image and certification label to external communication are the most significant expected benefits in terms of branding and image;
- Continuous improvement of ecodesign implementation and improved communication and knowledge sharing on ecodesign are the most significant expected benefits in terms of process management;
- Certifications based on different steps (scores or levels) are preferred over single level certification (yes/no); and
- The majority of companies are either interested or very interested in having a process-related certification tool for ecodesign implementation.

This research is developed in the context of a larger project, which aims to support companies on ecodesign implementation and management by means of the Ecodesign Maturity Model (EcoM2).

The Ecodesign Maturity Model (EcoM2) is a methodological framework focused on a process-improvement approach that supports companies on a systematic and consistent implementation and management of ecodesign, based on a diagnosis of a company's current ecodesign maturity profile, with particular focus on ecodesign implementation [15].

EcoM2 opens up the opportunity to develop an ecodesign process-related certification scheme, which would allow companies to communicate the maturity of their processes for the development of products with improved environmental performance. Such a scheme would eliminate the need for having several product-related eco-labels by just one process-related label for the entire company, which in turn would

facilitate the communication and transparency of information. Future research will focus on the development of a certification scheme based on the EcoM2, employing the results achieved in this survey in the definition of requirements for the certification.

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